VISTA Technologies, Inc.
Radiation Safety Program

PROCEDURE - 23

RADIOACTIVE MATERIALS SHIPMENT

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ABBREVIATIONS AND ACRONYMS

α	-	Alpha
ß	-	Beta
γ	-	Gamma
μ	-	Micro
^{241}Am	-	Americium-241
^{137}Ce	-	Cesium-137
^{234}Pa	-	Protactinium-234
^{210}Pb	-	Lead-210
^{210}Po	-	Polonium-210
^{214}Po	-	Polonium-214
^{218}Po	-	Polonium-218
^{232}Pu	-	Plutonium-232
^{226}Ra	-	Radium-226
^{228}Ra	-	Radium-228
^{219}Rn	-	Radon-219 (Actinium Series)
^{220}Rn	-	Radon-220 (Thorium Series)
^{222}Rn	-	Radon-222 (Uranium Series)
^{89}Sr	-	Strontium-89
^{90}Sr	-	Strontium-90
^{230}Th	-	Thorium-230
^{232}Th	-	Natural Thorium
^{238}U	-	Uranium-238
μCi	-	MicroCurie
μCi/hr	-	MicroCuries per hour
μCi/ml	-	MicroCuries per milliliter
μM	-	Micrometer
μR/hr	-	MicroRoentgen per hour
μg/mg	-	Microgram per milligram
ALARA	-	As low as reasonably achievable
ALI	-	Annual limit on intake
ANSI	-	American National Standards Institute
APR	-	Air-purifying respirator
Bq	-	Becquerel
Bq/m^3	-	Becquerels per cubic meter of air
BZ	-	Breathing Zone
C	-	Coulomb
C/kg	-	Coulombs per kilogram
CDE	-	Committed Dose Equivalent
CEDE	-	Committed Effective Dose Equivalent

CFR	-	Code of Federal Regulations
Ci	-	Curie
CIH	-	Certified Industrial Hygienist
CFM	-	Cubic feet per minute
CLIA	-	Clinical Laboratories Improvement Act
CLP	-	Contract Laboratory Program
cm	-	Centimeter
cm/sec	-	Centimeters per second
cpm	-	Counts per minute
CPR	-	Cardiopulmonary resuscitation
CSE	-	Certified Safety Executive
(D)	-	Duplicate count
DAC	-	Derived air concentration
DAC-h	-	DAC hours
DCA	-	Double Contingency Analysis
DDE	-	Deep Dose Equivalent
DI	-	De-ionized water
DOT	-	U.S. Department of Transportation
dm^2	-	Square Decimeter; one square decimeter equals 100 square centimeters
dpm	-	Disintegrations per minute
dpm/cm^2	-	Disintegrations per minute per square centimeter
dpm/dm^2	-	Disintegrations per minute per square decimeter
dps	-	Disintegrations per second
DRD	-	Direct reading dosimeter
DU	-	Depleted uranium
EPA	-	U.S. Environmental Protection Agency
eV	-	Electronvolt
FE	-	Feces sample
FIDLER	-	Field instrument for detection of low energy radiation
FR	-	Filter ratio
FSP	-	Field Sampling Plan
ft^2	-	Square foot
γ	-	Gamma ray
GA	-	General area
GeLi	-	Germanium - Lithium
G-M	-	Geiger-Mueller
GMC-H	-	Mine Safety Appliances Company, full-facepiece, dual ..combination filter cartridges for an APR
GPD	-	Gaseous Diffusion Plang
h	-	hours
He-3	-	Helium Three (3)

HEPA	-	High efficiency particulate air
HNO_3	-	Nitric acid
HP	-	Health Physics
hr	-	Hour
HS	-	Hot spot (radiation)
HSP	-	Site-specific Health and Safety Plan
HWP	-	Hazardous Work Permit
ICRP	-	International Commission on Radiological Protection
ID	-	Identification
IDLH	-	Immediately dangerous to life or health
IDW	-	Investigation derived waste
IP	-	Ionization potential
IVC	-	Independent verification contractor
keV	-	Kiloelectronvolt
kg	-	Kilogram
LANL	-	Los Alamos National Laboratory
lpm	-	Liters Per Minute
MCA	-	Multi-channel analyzer
MDA	-	Minimum detectable activity
meV	-	Millielectronvolt
m	-	Meter
m^2	-	Squared Meters
m^3	-	Cubic meters
mCi	-	MilliCurie
MSHP	-	Manager, Vista Safety and Health Program
mil	-	1/1000 inch
ml	-	Milliliter
mm	-	Millimeter
mR	-	MilliRoentgen
mR/hr	-	MilliRoentgens per hour
mrem	-	Millirem
mrem/hr	-	Millirems per hour
MSA	-	Mine Safety Appliances Company
MSDS	-	Material Safety Data Sheet
MSHA	-	Mine Safety and Health Administration
NaI	-	Sodium iodide
NCA	-	Nuclear Criticality Analysis
NCS	-	Nuclear Criticality Safety
NCRP	-	National Council on Radiation Protection and Measurements
NEA	-	Nuclear Energy Agency
NIST	-	National Institute of Science and Technology

NIOSH	-	National Institute for Occupational Safety and Health
n. o. s.	-	Not otherwise specified
NPDES	-	National Pollutant Discharge Elimination System
NRC	-	U.S. Nuclear Regulatory Commission
NS	-	Nose swipe
NTIS	-	National Technical Information Service
NVLAP	-	National Voluntary Laboratory Accreditation Program
OHSO	-	On-Site Health and Safety Officer
ORNL	-	Oak Ridge National Laboratory
ORPO	-	On-Site Ionizing Radiation Protection Officer
OSHA	-	U.S. Occupational Safety and Health Administration
pCi	-	PicoCurie
pCi/gm	-	PicoCuries per gram
pCi/l	-	PicoCuries per liter
P.E.	-	Professional Engineer
PF	-	Protection Factor
PIC	-	Pocket ion chamber
PM	-	Project Manager
PMT	-	Photomultiplier Tube
PPE	-	Personal protective equipment
PRP	-	Potentially responsible party
PRS	-	Portable ratemeter/scaler
PVC	-	Polyvinyl chloride
QA	-	Quality assurance
QC	-	Quality control
R	-	Roentgen
RA	-	Restricted (radiation) area
rad	-	Radiation absorbed dose
RAS-1	-	Kurz air sampling pump flow calibration kit
REM	-	Roentgen equivalent man
RHSC	-	Radiation Health and Safety Committee
RSO	-	VISTA Radiation Safety Officer
RWP	-	Radiation work permit
SAP	-	Sampling and Analysis Plan
SCBA	-	Self-contained breathing apparatus
SRD	-	Self-reading dosimeter
TODE	-	Total Organ Dose Equivalent
TLD	-	Thermoluminescent dosimeter
TWA	-	Time-weighted average

NIOSH	-	National Institute for Occupational Safety and Health
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NTIS	-	National Technical Information Service
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OHSO	-	On-Site Health and Safety Officer
ORNL	-	Oak Ridge National Laboratory
ORPO	-	On-Site Ionizing Radiation Protection Officer
OSHA	-	U.S. Occupational Safety and Health Administration
pCi	-	PicoCurie
pCi/gm	-	PicoCuries per gram
pCi/l	-	PicoCuries per liter
P.E.	-	Professional Engineer
PF	-	Protection Factor
PIC	-	Pocket Ionization Chamber
PM	-	Project Manager
PMT	-	Photomultiplier Tube
PPE	-	Personal Protective Equipment
PRP	-	Potentially Responsible Party
PRS	-	Portable ratemeter/scaler
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U^{nat}	-	Natural uranium
UR	-	Urine sample
U.S.	-	United States
VISTA	-	Vista Technologies, Inc.
VSHP	-	VISTA Safety and Health Program
VRSP	-	VISTA Radiation Safety Program
WL	-	Working Level
WP	-	Work Plan

RADIOACTIVE MATERIALS SHIPMENT

1. PURPOSE AND SCOPE

This procedure specifies requirements, criteria, and methods for shipping packaged radioactive material in compliance with applicable federal and state regulations, executive orders, burial site licenses, site criteria, and Vista policies. Adherence to this procedure will provide reasonable assurance that radioactive materials will be shipped in accordance with applicable regulations.

Radioactive materials shipments could include soils, radioactive sources, contaminated tools, material or equipment, and samples. Vista will be responsible for shipping their own radioactive material in accordance with U.S. Department of Transportation (DOT) regulations, 10 CFR 71, "Packaging and Transportation of Radioactive Material", and 10 CFR 20 "Standards for Protection Against Radiation."

Additionally, DOT regulations apply to radioactive materials having a specific activity of at least 2,000 pCi per gram (pCi/gm). Samples with a specific activity less that 2,000 pCi/gm are designated as "Excepted Package, Limited Quantity" by DOT. Vista radioactive material brokers are responsible for verifying that the radioactive material they ship can legally be received by the intended recipient.

The following sections discuss references and regulations, and shipping radioactive check sources.

2. REFERENCES AND REGULATIONS

Anyone that ships radioactive material should review the following references:

- 10 CFR 71, "Packaging and Transportation of Radioactive Material";
- 10 CFR 20 "Standards for Protection Against Radiation,"
- "A Review of the Department of Transportation Regulations for the Transportation of Radioactive Materials,"; and
- 49 CFR 1-179, Hazardous Material Regulations

3. SHIPPING RADIOACTIVE CHECK SOURCES

The following procedure will be used to transport "limited quantity" radioactive check sources.

- Place the radioactive check source in an envelope or container. Use appropriate fasteners or tape to seal the inside package.
- Affix a label to the inner package bearing the term "Radioactive."
- Place the inner package into a padded envelope or sturdy box before shipping. Insert a packing list into the outer container or attach it to the outside of the outer container. Seal the outer container using fasteners or tape.
- The packing list must contain the following information:

Note: For the purposes of this document Ionizing Radiation includes Non-Ionizing Radiation

- Name of consignor or consignee
- Address of consignor or consignee
- Statement: "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, not otherwise specified, UN2910."

- Survey the package to ensure that it meets the following limitations:
  - The radiation level at the surface of the package must be less than 0.5 mrem/hr.
  - There must be no significant removable contamination on the surface of the package.

- For α emitting radionuclides the removable contamination limit is 2.22 dpm per square centimeter (dpm/cm^2).
- For ß emitting radionuclides the removable contamination limit is 22.0 dpm/cm^2.
- The quantity limitations specified for a single container are as follows:
- The quantity limitations specified for a single container are as follows (as per 10 CFR 71 Appendix A-1: Normal form material i.e., A_1 values):

Table 1 - Quantity Limitations of Radionuclide for a Single Container

Radionuclide	Package Limit (Curies) Normal form
Americium-241	0.00541
Plutonium-239	0.00541
Radium-226	0.541
Strontium-90	2.70
Cesium-137	13.5
Technetium-99	24.3
Thorium-230	0.00541
Others (e.g., Fission Products, etc.)	As per 10 CFR 71 Appendix A Table A-1, A_1 Values.

Note: For the purposes of this document Ionizing Radiation includes Non-Ionizing Radiation

- Sources packaged under "limited quantity" provisions of 49 CFR 173 may be shipped via commercial carriers or by personal vehicle. They may also be placed in packages containing other field materials, such as ionizing radiation survey instruments, sampling tools, etc. Labeling of the outer containers is not required. There is no limitation on the number of "limited quantity" packages per vehicle.

4. APPLICABILITY

This procedure will be used by Vista to prepare required shipping papers, secure loads, and ship radioactive materials.

5. SHIPPING RADIOACTIVE MATERIAL

5.1. Definitions

- *A_1 Activity* - The maximum activity of special form Class 7 (radioactive) materials permitted in a Type A package.
- *A_2 Activity* - The maximum activity of Class 7 (radioactive) materials, other than special form, LSA (Low Specific Activity) or SCO (Surface Contaminated Object) permitted in a Type A package.
- *Bulk Packaging* - A packaging, other than a vessel or a barge, including a transport vehicle or freight container, in which hazardous materials are loaded with no intermediate form of containment and which has:
  - a) A maximum capacity greater than 450 L (119 gals) as a receptacle for a liquid;
  - b) A maximum net mass greater than 400 kg (882 lb.) and a maximum capacity greater than 450 L (119 gals) as a receptacle for a solid; or
  - c) A water capacity greater than 454 kg (1000 lbs.) as a receptacle for a gas as defined in 173.115 of 49 CFR Subpart D.
- *Carrier* - Any individual or organization engaged in the transportation of passengers or property.
- *Closed Transport Vehicle* - A transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transport restricts the access of unauthorized persons to the cargo space containing Class 7 (radioactive) materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the see-through' type, and must limit access from top, sides and bottom.
- *Consignee* - Any individual or organization that receives material from a carrier.
- *Consignor* - Any individual or organization that furnishes material to a carrier for transportation.
- *Depleted Uranium* - Uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

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- *Exclusive Use* - The sole use of a conveyance by a single consignor of a conveyance and for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. (The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment - the consignor must issue specific instructions in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor (also referred to in other regulations as *Sole Use* or *Full Load).*

- *Fissile Material* - Any material consisting of or containing one or more fissile radionuclides - Fissile radionuclides are plutonium-238, plutonium-239, plutonium-241, uranium-233, and uranium - 235 - neither natural nor depleted uranium is fissile material - Fissile materials are classified according to the controls needed to provide nuclear criticality safety during transportation, as provided in 49CFR173.455.

- *Freight Container* - A reusable container having a volume of cubic meters (64 cubic feet) or more, designed and constructed to permit being lifted with its contents intact and intended primarily for containment of packages in unit form during transport. A small freight container is one that has either one outer dimension less than 1.5 meters (4.9 feet) or an internal volume of not more than 3.0 cubic meters (106 cubic feet). All other are designated as large freight containers.

- *Highway Route Controlled Quantity (HRCQ)* - The quantity of radioactive material within a single package which exceeds the following:

  a) The quantity of radioactive material is 3,000 times the A_1 value of the radionuclides for special form Class 7 (radioactive) material;
  b) The quantity of radioactive material is 3,000 times the A_2 value for normal form Class 7 (radioactive) material;
  c) The quantity of radioactive material is equal to or exceeds 27,000 Curies, whichever is least.

- *Limited Quantity of Class 7 (Radioactive) Material (LQ)* - A quantity of Class 7 (radioactive) material not exceeding the materials package limits specified in 49CFR173.425 and which conform to requirements specified in 49CFR173.421.

- *Low Specific Activity Materials (LSA)* - LSA material means Class 7 (radioactive) material with limited specific activity which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of the three groups:

  LSA-I

  a) Ores containing only naturally occurring radionuclides (e.g., uranium and thorium) and uranium and thorium concentrates of such ores; or
  b) Solid unirradiated natural or depleted uranium or natural thorium.

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c) Class 7 (radioactive) material, other than fissile material, for which the A_2 value is unlimited; or
d) Mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which the Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed $106A_2/g$.

LSA-II

a) Water with tritium concentration up to 20 curies per liter; or
b) Material in which the Class 7 (radioactive) material is essentially distributed throughout and the average specific activity does not exceed $1T'A_2/g$ for solids and gases, and $10^5A_2/g$ for liquids.

LSA-III Solids (e.g., consolidated wastes, activated materials) that meet the requirements of 49CFR173.468 and which:

a) The Class 7 (radioactive) material is essentially distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc; and
b) The Class 7 (radioactive) material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of Class 7 (radioactive) materials per package by leaching when placed in water for seven days would not exceed 0.1 $A_{2/g}$ and
c) The average specific activity of the solid does not exceed 2 x $10^{-3}A_2/g$.

- *Non-Bulk Packaging* - A packaging which has:

a) A maximum capacity greater than 450 L (119 gals) as a receptacle for a liquid;
b) A maximum net mass greater than 400 kg (882 lbs.) and a maximum capacity greater than 450 L (119 gals) as a receptacle for a solid; or
c) A water capacity greater than 454 kg (1,000 lbs.) as a receptacle for a gas as defined in 173.115 of 49CFR Subpart D.

- *Non-Fixed Radioactive Contamination* - Radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in 49 CFR 173.443.

- *Normal Form Radioactive Material* - Radioactive material which has not been demonstrated to qualify as special form radioactive material.

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- *N.O.S.* - Abbreviation denoting "Not Otherwise Specified" which is used on shipping papers to generically describe radioactive materials.

- *Radioactive Material* - Materials having a specific activity greater than 0.002 microcuries per gram (pCi/g).

- *Special Form Radioactive Material* - Radioactive material which satisfies the following conditions:
  a) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
  b) The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inches); and
  c) It satisfies the test requirements of 49 CFR 173.469 and special requirements in 49 CFR 173.389.

- *Specific Activity* - The activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

- *Surface Contaminated Object (SCO)* - A SCO means a solid object which is not itself radioactive but which has Class 7 (radioactive) materials distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limits:

SCO-I. A solid object on which:

a) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed i0~ microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 1o~ microcurie/cm^2 for alpha emitters;
b) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1.0 microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 0.1 microcurie/cm^2 for all other alpha emitters; and
c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1.0 microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 0.1 microcurie/cm^2 for all other alpha emitters.

SCO-II. A solid object on which the limits for SCO-I are exceeded and on which:

a) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 102 microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 10 microcurie/cm^2 for alpha emitters;
b) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300

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cm^2) does not exceed 20 microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 2 microcurie/cm^2 for all other alpha emitters; and

c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 20 microcurie/cm^2 for beta and gamma and low toxicity alpha emitters, or 2 microcurie/cm^2 for all other alpha emitters.

- *Transport Index (TI)* - A dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is determined as follows:

  a) For nonfissile material packages, the number determined by multiplying the maximum radiation level in milliSievert(s) per hour at one meter (3.3 feet) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)); or

  b) For fissile material packages, the number determined by multiplying the maximum radiation level in milliSievert per hour at one meter (3.3 feet) from any external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)) or, for criticality control purposes, the number obtained by dividing 50 by the allowable number of packages which may be transported together, whichever number is larger.

- *Type A Package* - A Type A packaging that, together with its radioactive contents limited to A_1 or A_2 as appropriate, meets the requirements of 49 CFR173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by test set forth in 49 CFR173.465 and 173.466, as appropriate. A Type A package does not require competent authority approval.

- *Type B Package* - A Type B packaging together with its radioactive contents, is designed to retain the integrity of containment and shielding required by 49 CFR173.410 and 173.412 when subjected to the normal transport and hypothetical accident test conditions set forth in 1O CFR71.

  Type B (U) package - Means a Type B packaging that, together with its radioactive contents, for international shipments require unilateral approval only of the package design and of any stowage provisions that may be necessary for heat dissipation.

  Type B (M) Package - Means Type B packaging, together with its radioactive contents, that for international shipments require multilateral approval of the package design, and may require approval of the conditions of shipment.

- *Type A Quantities* - A quantity of Class 7 (radioactive) material, the aggregate radioactivity which does not exceed A_1 for special form Class 7 (radioactive) material, or A_2 for normal form Class 7 (radioactive) material.

- *Type B Quantities* - Means a quantity of material greater than a Type A quantity.
- *Waste Broker (WB)* -A person specifically trained in transportation and will have current 49 CFR 172 Subpart H training; disposal training (NRC Information Notice 79-19), and will meet all applicable military, federal, state and local requirements for the handling, packaging, and shipment of unwanted radioactive material. In addition, the person should be authorized by Vista to perform shipments of radioactive/hazardous materials and waste between licensees and to burial/disposal facility.

5.2. Precautions and Prerequisites

5.2.1. The individual shall hold the appropriate current certification or qualification as a Vista Waste Broker or equivalent in accordance with accepted industry standards.

5.2.2. Shipments shall not be performed unless the shipper has documented evidence showing authority to use the appropriate disposal site (User's Permit), ship into or within the state (Transportation Permit), and/or ship into or out of a state or compact, as applicable.

5.2.3. The Waste Broker shall confer with cognizant individuals such as the Materials Management Supervisor, Manager of Health & Safety, the waste generator, and others as necessary concerning local, state, or compact restrictions prior to shipping.

5.2.4. The Waste Broker shall review the consignee's license and acceptance criteria, as applicable, for authorization to accept the radioactive material to be shipped prior to release of the shipment.

5.2.5. General instructions and guidelines for the inspection and shipping of radioactive material are found in Section 5 of this Procedure and various appendices.

5.2.6. The Waste Broker should review the guidance in Section 5 of this Procedure in preparing for the shipment.

5.2.7. The final verification of a shipment shall occur only after inspection of the packages and the conveyance confirms that the shipment is in compliance with all applicable rules, regulations, and license conditions, as discussed in Section 5 of this Procedure.

5.2.8. Specific requirements applicable to an individual disposal facility are found in the various appendices.

5.2.9. Prior to consigning radioactive material for transport, the Waste Broker shall verify that the receiver possesses a license issued by the NRC (Nuclear Regulatory Commission) or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred.

6. RESPONSIBILITIES

- The Waste Broker is responsible for waste characterization, packaging of waste, negotiations with carriers, and negotiations with disposal facilities.

- Technicians shipping radioactive materials are responsible for complying with provisions of this procedure.

7. DETAILED PROCEDURE

Many generators present Vista with pre-packaged radioactive material (deemed unwanted). Repackaging each container for the purpose of inspection is not possible because of ALARA (As Low As Reasonably Achievable) concerns. Based on documented contents of some packages, the material will have the potential of high levels of radioactive contamination, as well as high contact dose rates. Opening these packages would create a situation in which contamination and airborne radioactive materials may be spread to the facility, personnel, and the environment. Since it is not possible to inspect and verify the complete contents of every package, these generators will be required to complete the Prepackaged Waste Certification, Appendix C.

7.1. Limitations on Packaging

Packaging of unwanted radioactive materials or waste may be performed in conjunction with preparation of materials for shipment if the following conditions are met.

- Total waste activity is less than or equal to 10% of the A2 value for non-sealed sources, or 10%of the A1 value for sealed sources; OR

- The material requiring packaging is prepackaged. In addition, the package contact external dose rate does not exceed 200 mR/hr (2 mSv/hr) Beta-gamma, and external contamination levels are less than 2,200 dpm/100 cm^2 (40 Bq/100 cm^2), Beta-gamma and less than 220 dpm/100 cm^2 (4 Bq/100 cm^2), Alpha, AND

- Decontamination is limited to the immediate waste packaging area, waste packages and/or transport vehicle, AND

- Protection from anticipated industrial safety hazards can be accomplished with typical personal protective equipment, hard hat, safety glasses/shield, safety shoes and gloves. The packaging operations will not involve personnel exposure to toxic or hazardous chemicals or atmospheres; AND

- The waste requiring packaging is covered by a DoD radioactive materials license, a review of the license will indicate if the proposed waste packaging activity is authorized or not specifically prohibited.

7.2. Prior to Loading of Packages

7.2.1. If prepackaged waste is to be processed, the Waste Broker shall ensure that he/she has obtained and verified that the Prepackaged Waste Certification form in Appendix C has been properly completed. The original form shall be retained by the Waste Broker and incorporated into the final shipment package with a copy included in the shipping paperwork.

Note: For the purposes of this document Ionizing Radiation includes Non-Ionizing Radiation

7.2.2. Visually inspect the vehicle condition and ensure any noted deficiencies are corrected prior to loading. Record the inspection results on the "Vehicle Inspection Sheet", in Appendix F.

7.2.3. If the vehicle floor shows evidence of moisture:

a) The floor will be wiped as dry as possible before loading.

b) The condition of the floor and the action taken will be noted on the Prior Notification Call Sheet, Vehicle Survey Form and/or other shipping forms. Consignee of the shipment shall be notified of the findings prior to shipment.

7.2.4. Perform a radiation and contamination survey of the vehicle prior to loading. Any vehicle which exceeds the applicable DOT limits shall not be loaded or used.

7.2.5. Enter survey data of vehicle on "Vehicle Radiation/Contamination Survey", in Appendix F.

7.2.6. Observe or perform a radiation and contamination survey of the packages.

7.2.7. Enter the survey data for each package on the "Waste Inventory Sheet" in Appendix F.

NOTE:	Packages, which exceed any applicable DOT limits, shall not be shipped.

7.2.8. All packages shall be inspected for internal freestanding fluids (water, oil, etc.), as applicable. See the "Post Checklist of Waste Broker's Work" in Appendix E.

a) Packages of solidified fluids shall be inspected by tapping the container. If a change of tone is heard, then water may be present in a void in the solid.
b) A random sampling of solidified fluid packages will be inspected by inverting the container, holding for 24 hours, uprighting, opening, and observing for liquids.
c) If the container is not a specification package, it can be inspected for fluid by opening a hole in the bottom edge and observing for fluids. The hole must be small enough to be sealed by a gasket or caulked metal screw.
d) Packages of absorbed fluids shall be inspected as described in this section.
e) Packages containing any internal fluids shall not be shipped unless they are in compliance with selected disposal site's waste acceptance criteria or the applicable recipient' s license.
f) If an inspection for internal fluids is required in packages that contain animal carcass and/or biological waste, the internal drum, carboy, or other containment will not be opened.

7.2.9. Check for abnormalities such as scintillation fluids, biological wastes, pyrophoric/flammable material, other hazardous materials, gas generation, mixed waste, etc.

7.2.10. Inspect all packages for appropriate markings and labels.

7.2.11. All handling procedures must be followed and requirements of the Certificates of Compliance (C of C) complied with when shipments are made in a NRC approved package (cask), a DOT approved TYPE B package, or a High Integrity Container (HIC).

7.2.12. Any packages which show evidence of external moisture, will not be certified for shipment unless and until:

a) The moisture is the result of natural precipitation or condensation and does not come from the package contents and this has been verified and documented in the comment section of the inspection form.
b) A smear pad is used to absorb a sample of the moisture, the sample is dried and counted to indicate the absence or presence of contamination. If radioactive contamination is found, the package must be decontaminated prior to shipment. Identify source of contamination and eliminate as practicable and document in comment section of the inspection form.
c) The packages are wiped as dry as possible of verified external moisture before the shipment leaves the site.

7.2.13. The lid to body gap on all B-25 type steel containers and similar containers shall be completely filled with silicone rubber sealant or equivalent prior to shipment.

7.2.14. Any package contents that could shift in transit shall be fixed in place or shall be verified to have internal containment/restraint to restrict shifting.

7.2.15. The Waste Broker should open any package of questionable quality, taking appropriate ALARA considerations, to ensure its ability to comply with all applicable regulations. The Waste Broker will document the concerns, actions taken, and rationale, if required.

7.2.16. Ensure all forms are complete prior to shipment of material.

7.2.17. Ensure package is appropriate for contents (e.g., 7A Type A, strong-tight container, etc.) and package test evaluation data is available and on file with the Waste Broker.

7.2.18. Use the "Post Checklist of Waste Broker's Work" in Appendix E as a guide to ensure all items are complete.

7.2.19. Due to DOT regulation changes, Radioactive Material, NOS 7, UN 2982, White I label shipments are generally not acceptable. Only Yellow II and Yellow III labels are allowed for labeled shipments of UN 2982 unless specifically authorized by the cognizant authority.

7.3. Vehicle Loading, Vehicle Inspection, and Shipping Papers.

7.3.1. Load the truck only with the packages listed on the "Waste Inventory Sheet" and Radiation Shipment Manifest (RSM)/ Radiation Shipment Record (RSR).

7.3.2. Complete radioactive waste shipment papers as identified on the Copy Distribution Sheets, Appendix D.

7.3.3. Sequentially number each separate page of the entire DOT paperwork package as part of a set, (e.g., 1 of 10, 2 of 10, etc.).

7.3.4. Use "Waste Inventory Sheet" to visually verify that all packages are loaded on the vehicle.

7.3.5. Verify proper blocking and bracing, dunnage, or tie downs.

7.3.6. Verify vehicle is properly placarded.

7.3.7. Perform a final contamination and radiation survey of the vehicle.

7.3.8. Record final survey data of vehicle on "Waste Broker's Vehicle Radiation/contamination Survey ", Appendix F.

7.3.9. Affix seals, if required, or verify that security seals have been affixed to drums, casks and/or trailer doors, as applicable.

7.3.10. Have driver and shipper/generator (or agent) sign all required forms. Sign Waste Broker certification, as applicable, to release the waste shipments.

7.3.11. Ensure all paperwork and copies are legible.

7.3.12. Make required copies and distribute according to "Copy Distribution Checklist" Appendix D.

NOTE:To the extent possible, ensure the drivers understanding of those instructions.

7.3.13. Ensure that any special instructions and/or comments from the receiving destination to the carrier are documented, and included in the shipping papers.

7.3.14. Verify that the driver has received all special instructions such as maintaining exclusive use, and making the prior notification phone calls; that they are recorded on the shipping documents, and that the driver has signed as receiving these instructions. For the purpose of emergency actions, ensure the driver has (a) copy(ies) of *Pocket Guide to Hazardous Materials, North American Emergency Response Guidebook* (1996 revision preferred, but at least 1993), or All pages of Appendix B Shipping Papers and Supporting Documents of this procedure.

7.3.15. Make required prior notifications and correction calls in accordance with "Post Checklist of Waste Broker's Work" in Appendix E.

7.3.16. Notify the Materials Management Supervisor or his designee of shipment.

7.3.17. Distribute copies of the shipping papers in accordance with the "Copy Distribution Checklist" Appendix D and release the shipment. Mail/fax a copy of the RSM cover sheet to the disposal site if shipping waste.

7.3.18. Each processing or disposal facility has prior to shipment notification procedures. Ensure the receiving facility's procedures for notification is followed. If in doubt call the receiving facility or the customer.

7.3.19. Actions taken in the event of error

a) If Waste Broker responsibilities are improperly executed and negligence is shown on the part of the Waste Broker, appropriate action will be taken in accordance with most current Vista personnel policies and procedures handbook.
b) If a Waste Broker is suspended from Brokering activities, he/she will not be reinstated until he/she is retrained.

8. QUALITY CONTROL

Instrumentation used in the surveys will be checked with standards daily and verified to have a current valid calibration.

9. RECORDS

A copy of all radiation surveys, contamination surveys and shipping documents will be retained in shipment specific files. The basic records that would be included in a shipping file are:

- The Vehicle Survey form - used to describe the areas or locations where surveys were performed, the results of those surveys, and any comments or notes that the surveyor, Broker, etc. may wish to document.

Note: For the purposes of this document Ionizing Radiation includes Non-Ionizing Radiation

- Prepackaged Waste Certification, if used; if the form is not required, it may be included and marked with shipment numbers and N/A for response portions.

- Any forms or documents that contain written information, comments, etc. that may be required in future with regard to the shipment and that may be regarded as part of the history of the transport.

- RSR/RSM and/or the Hazardous Waste Manifest (HWM) and the carrier's bill of lading defines the shipment.

- Shipping paperwork shall be held in the Waste Broker's office until after delivery and acceptance/completion of the shipment.

- Original shipping documents will be retained by Waste Broker's office for proper archiving.

- Original radiation safety documents will be retained by the RSO's office for proper archiving. Copies of this paperwork may be retained with the shipping package, - if desired.

Appendix A

TRANSPORTATION PAPERS

DOT Shipping Papers (49 CFR 172.200-205) (1 Page)
Marking Packages (49 CFR 172.300-338) (2 Pages)
Labeling Packages (49 CFR 172.400-450) (2 Pages)
Minimum Required Packaging for Class 7 Radioactive Materials (1 Page)
Package and Vehicle Contamination Limits (49 CFR 173.443) (1 Page)

Hazard Communications for Class 7 (Radioactive) Materials

DOT Shipping Papers (49 CFR 172.200-205)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Entries Always Required Unless Excepted

- The basic description, In sequence: **Proper Shipping Name, Hazard Class (7), U.N. Identification Number**
- 24 hour **emergency response telephone number**
- Name of **shipper**
- Proper page numbering (Page 1 of 4)
- Except for empty and bulk packages, the **total quantity** (mass, or volume for liquid), in appropriate units (lbs, mL....)
- If not special form, **chemical and physical form**
- The **name of each radionuclide** (95% rule) and total package activity. The activity must be in SI units (e.g., Bq, TBq), or both SI units and customary units (e.g., Ci, mCi). However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97.
- For each labeled package:
  - The **category of label** used;
  - The **transport index** of each package with a Yellow-II or Yellow-III label
- Shipper's **certification** (not required of private carriers)

Additional Entries Sometimes Required

Materials-Based Requirements:

- If hazardous substance, "RQ" as part of the basic description
- The LSA or SCO group (e.g., LSA-II)
- "Highway Route Controlled Quantity" as part of the basic description , if HRCQ
- Fissile material information (e.g., "Fissile Exempt," controlled shipment statement [see §172.203(d)(7)])
- If the material is considered hazardous waste and the word waste does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive Material, nos, UN2982)
- "Radioactive Material" if not in proper shipping name

Package-Based Requirements:

- Package identification for DOT Type B or NRC certified packages
- IAEA CoC ID number for export shipments or shipments using foreign-made packaging (see §173.473)

Administrative-Based Requirements:

- "Exclusive Use-Shipment"
- Instructions for maintenance of exclusive use-shipment controls for LSA/SCO strong-tight or NRC certified LSA (§ 173.427)
- If a DOT exemption is being used, "DOT-E" followed by the exemption number

Optional Entries

- The type of packaging (e.g., Type A, Type B, IP-1, ...)
- The Technical/chemical name may be in included (if listed in §172.203(k), in parentheses between the proper shipping name and hazard class; otherwise inserted in parenthesis after the basic description)
- Other information is permitted (e.g., functional description of the product), provided it does not confuse or detract from the proper shipping name or other required information
- For fissile radionuclides, except Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may be used *in place of* activity units. For Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may optionally be entered *in addition to* activity units [see § 172.203(d)(4)]
- Emergency response hazards and guidance information (§§ 172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers [§ 172.602(b)]

Some Special Considerations/Exceptions for Shipping Paper Requirements

- Shipments of Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quanttiy is not a hazardous substance (RQ) or hazardous waste (40 CFR 262)
- Shipping papers must be in the pocket on the left door, or readily visible to person entering driver's compartment and within arm's reach of the driver
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, or be highlighted in a contrasting color

Hazard Communications for Class 7 (Radioactive) Materials

Marking Packages (49 CFR 172.300-338)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Markings Always Required Unless Excepted

Non-Bulk Packages

- Proper shipping name
- U.N. identification number
- Name and address of consignor or consignee, *unless*:
  - highway only and no motor carrier transfers, or
  - part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [see §172.301(d)]

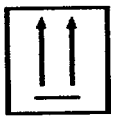
Bulk Packages (i.e., net capacity greater than 119 gallons as a receptacle for liquid, or 119 gallons and 882 pounds as a receptacle for solid, or water capacity greater than 1000 lbs, with no consideration of intermediate forms of containment)

- U.N. identification number, on orange, rectangular panel (see §172.332) - some exceptions exist

Additional Markings Sometimes Required

Materials-Based Requirements:

- If in excess of 110 lbs (50 kg), Gross Weight



- If non-bulk liquid package, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking]
- If a Hazardous substance in non-bulk package, the letters "RQ" in association with the proper shipping name

Package-Based Requirements:

- The package type if Type A or Type B (½" or greater letters)
- The specification-required markings [e.g., for Spec. 7A packages: "DOT 7A Type A" and "Radioactive Material" (see §178.350-353)]
- For approved packages, the certificate ID number

(e.g., USA/9166/B(U), USA/9150/B(U)-85, ...)

- If Type B, the trefoil (radiation) symbol per Part 172 App. B [*size*: outer radius ≥ 20 mm (0.8 in)]
- For NRC certified packages, the model number, gross weight, and package ID number (10 CFR 71.85)

Administrative-Based Requirements:

- If a DOT exemption is being used, "DOT-E" followed by the exemption number
- If an export shipment, "USA" in conjunction with the specification markings or certificate markings

Optional Markings

- "IP-1," "IP-2," or "IP-3" on industrial packaging is recommended
- Both the name and address of consignor and consignee are recommended
- Other markings (e.g., advertising) are permitted, but must be sufficiently away from required markings and labeling

Some Special Considerations/Exceptions for Marking Requirements

- Marking is required to be: (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package
- Limited Quantity (§173.421) packages and Articles Containing Natural Uranium and Thorium (§173.426) must bear the marking "radioactive" on the outside of the inner package or the outer package itself, and are excepted from other marking. The excepted packages shipped under UN 2910 must also have the accompanying statement that is required by §173.422.

- Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking
- Shipment of LSA or SCO required by §173.427 to be consigned as exclusive use are excepted from marking except that the exterior of each nonbulk package must be marked "**Radioactive-LSA**" or "**Radioactive-SCO,**" as appropriate. Examples of this category are domestic, strong-tight containers with less than an A_2 quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52.
- For bulk packages, marking may be required on more than one side of the package (see 49 CFR 172.302(a))

Hazard Communications for Class 7 (Radioactive) Materials

Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Placement of Radioactive Labels

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface (not the bottom), (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package
- For labeling of radioactive materials packages, two labels are required on opposite sides excluding the bottom

Determination of Required Label

Size:

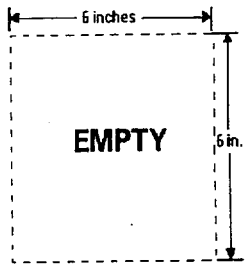
Sides: ≥ 100 mm (3.9 in.)

Border: 5-6.3 mm (0.2-0.25 in.)

49 CFR 172.436

49 CFR 172.438

49 CFR 172.440



49 CFR 172.450

Label	**WHITE-I**	**YELLOW-II**	**YELLOW-III**	**EMPTY LABEL**
Required when:	Surface radiation level < 0.005 mSv/hr (0.5 mrem/hr)	0.005 mSv/hr (0.5 mrem/hr) < surface radiation level ≤ 0.5 mSv/hr (50 mrem/hr)	0.5 mSv/hr (50 mrem/hr) < surface radiation level < 2 mSv/hr (200 mrem/h) [Note: 10 mSv/hr (1000 mrem/hr) for exclusive-use closed vehicle (§173.441(b)]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to **§173.428**. It must cover any previous labels, or they must be removed or obliterated.
Or:	**TI = 0** [1 meter dose rate < 0.0005 mSv/hr (0.05 mrem/hr)]	**TI < 1** [1 meter dose rate < 0.01 mSv/hr (1 mrem/hr)]	**TI ≤ 10** [1 meter dose rate < 0.1 mSv/hr (10 mrem/hr)] [Note: There is no *package* TI limit for exclusive-use]	

Notes:

- Any package containing a Highway Route Controlled Quantity **(HRCQ) must bear YELLOW-III label**
- Although radiation level transport indices (TIs) are shown above, **for fissile material**, the TI is typically determined on the basis of criticality control

Content on Radioactive Labels

- RADIOACTIVE Label must contain (entered using a durable, weather-resistant means):
  - (1) The radionuclides in the package (with consideration of available space). Symbols (e.g., Co-60) are acceptable
  - (2) The activity in SI units (e.g., Bq, TBq), or both SI units with customary units (e.g., Ci, mCi) in parenthesis. However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97.
  - (3) The Transport Index (TI) in the supplied box. The TI is entered *only* on YELLOW-II and YELLOW-III labels

Some Special Considerations/Exceptions for Labeling Requirements

- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, and must not display the hazard class number
- Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from labeling. However, if the excepted quantity meets the definition for another hazard class, it is re-classed for that hazard. Hazard communication requirements for the other class are required
- Labeling exceptions exist for shipment of LSA or SCO required by § 173.427 to be consigned as exclusive use
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§ 172.402(c)]

Hazard Communications for Class 7 (Radioactive) Materials

Placarding Vehicles (49 CFR 172.500-560)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
  - on four sides of the vehicle
  - visible from the direction they face, (for the front side of trucks, tractor-front, trailer, or both are authorized)
  - clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins)
  - at least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness
  - upright and on-point such that the words read horizontally
  - in contrast with the background, or have a lined-border which contrasts with the background
  - such that dirt or water from the transport vehicle's wheels will not strike them
  - securely attached or affixed to the vehicle, or in a holder.
- Placard must be maintained by carrier to keep color, legibility, and visibility.

Conditions Requiring Placarding

- Placards are required for any vehicle containing package with a RADIOACTIVE Yellow-III label
- Placards are required for shipment of LSA or SCO required by §173.427 to be consigned as exclusive use. Examples of this category are domestic, strong-tight containers with less than an A_2 quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52. Also, for bulk packages of these materials, the orange panel *marking* with the UN Identification number is not required.
- Placards are required any vehicle containing package with a Highway Route Controlled Quantity (**HRCQ**). In this case, the placard must be placed in a square background as shown below (see §173.507(a))

Radioactive Placard

Size Specs:

Sides: ≥ 273 mm (10.8 in.)

Solid line Inner border: About 12.7 mm (0.5 in.) from edges

Lettering: ≥ 41 mm (1.6 in.)

Square for HRCQ: 387mm (15.25 in.) outside length by 25.4 mm (1 in.) thick

49 CFR 172.556

RADIOACTIVE PLACARD (Domestic)

Base of yellow solid area: 29 ± 5 mm (1.1 ± 0.2 in.) above horizontal centerline

IAEA SS 6 (1985) paras. 443-444

RADIOACTIVE PLACARD (International)

See 49 CFR 172.527 AND 556

RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY
(either domestic or international placard could be in middle)

Some Special Considerations/Exceptions for Placarding Requirements

materials. However, some import shipments may have this substitution in accordance with international regulations.

- Bulk packages require the orange, rectangular panel marking containing the UN ID number, which must be placed adjacent to the placard (see §172.332) [NOTE: except for LSA/ SCO exclusive use under §173.427, as above]
- If placarding for more than one hazard class, subsidiary placards must not display the hazard class number. Uranium Hexaflouride (UF_6) shipments $\geq$ 454 kg (1001 lbs) require both RADIOACTIVE and CORROSIVE (Class 8) placarding
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE - YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera)

Minimum Required Packaging For Class 7 (Radioactive) Materials

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Quantity:	< 70 Bq/g (< 0.002 μCi/g)	Limited Quantity (§173.421)	A_1/A_2 value (§173.435)	1 rem/hr at 3 m, unshielded (§173.427)

Non-LSA/SCO:	Excepted	Type A	Type B [3]	
Domestic or International LSA/SCO: LSA-I solid, (liquid)[1] SCO-I	Excepted	IP-I		Type B [3]
LSA-I Liquid LSA-II Solid, (liquid or gas)[1] (LSA-III)[1] SCO-II		IP-II		Type B [3]
LSA-II Liquid or Gas LSA-III		IP-III		Type B [3]
Domestic (only) LSA/SCO: LSA-I, II, III; SCO-I, II	Excepted	Strong-tight [2]	DOT Spec. 7A Type A	Type B [3] / NRC Type A LSA [3,4]

1. For entries in parentheses, exclusive use is required for shipment in an IP (e.g., shipment of LSA-I liquid in an IP-I packaging would require exclusive use consignment)
2. Exclusive use required for strong-tight container shipments made pursuant to §173.427(b)(2)
3. Subject to conditions in Certificate, if NRC package
4. Exclusive use required, see §173.427(b)(4). Use of these packages expires on 4/1/99 (10 CFR 71.52)

Package and Vehicle Radiation Level Limits (49 CFR 173.441) [A]

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Transport Vehicle Use:	**Non-Exclusive**	**Exclusive**		
Transport Vehicle Type:	Open or Closed	Open (flat-bed)	Open w/Enclosure [B]	Closed
Package (or freight container) **Limits:**				
External Surface	2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**
Transport Index (TI) [C]	10	no limit		
Roadway or Railway Vehicle (or freight container) **Limits:**				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr **(200 mrem/hr)**
Vertical planes projected from outer edges		2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	N/A
Top of . . .		load: **(200 mrem/hr)**	enclosure: 2 mSv/hr **(200 mrem/hr)**	vehicle: 2 mSv/hr **(200 mrem/hr)**
2 meters from. . .		vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	outer lateral surfaces: 0.1 mSv/hr **(10 mrem/hr)**
Underside		2 mSv/hr **(200 mrem/hr)**		
Occupied position	N/A [D]	0.02 mSv/hr **(2 mrem/hr)** [E]		
Sum of package TI's	50	no limit [F]		

A. The limits in this table do not apply to excepted packages - see 49 CFR 173.421-426
B. Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures
C. For nonfissile radioactive materials packages, the dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour
D. No dose limit is specified, but separation distances apply to Radioactive Yellow-II or Radioactive Yellow-III labeled packages
E. Does not apply to private carrier wearing dosimetry if under radiation protection program satisfying 10 CFR 20 or 49 CFR 172 Subpa
F. Some fissile shipments may have combined conveyance TI limit of 100 - see 10 CFR 71.59 and 49 CFR 173.457

Package and Vehicle Contamination Limits (49 CFR 173.443)

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm^2
Sufficient measurements must be taken in the appropriate locations to yield representative assessments

&(means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters
" means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters)

	General Requirement: Non-fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)
The Basic Contamination Limits for All Packages: 49 CFR 173.443(a), Table 11	**&(: 0.4 Bq/cm^2 = 40 Bq/100 cm^2 = 1x10^{-5} :Ci/cm^2 = 2200 dpm/100 cm^2**
	": 0.04 Bq/cm^2 = 4 Bq/100 cm^2 = 1x10^{-6} :Ci/cm^2 = 220 dpm/100 cm^2

The following exceptions and deviations from the above basic limits exist:

Deviation from Basic Limits	Regulation 49 CFR §§	Applicable Location and Conditions Which must Be Met:
10 times the basic limits	173.443(b) and 173.443(c) Also see 177.843 (highway)	On any external surface of a package in an **exclusive use shipment, during transport** including end of transport. Conditions include: (1) Contamination levels at beginning of transport must be below the basic limits. (2) Vehicle must not be returned to service until radiation level is shown to be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.
10 times the basic limits	173.443(d) Also see 177.843 (highway)	On any external surface of a package, at the beginning or end of transport, if a closed transport vehicle is used, solely for transporting radioactive materials packages. Conditions include: (1) A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft). (2) Exterior of vehicle must be conspicuously stenciled, **"For Radioactive Materials Use Only"** in letters at least 76 mm (3 inches) high, on both sides. (3) Vehicle must be kept closed except when loading and unloading.
100 times the basic limits	173.428	**Internal** contamination limit for **excepted package-empty packaging**, Class 7 (Radioactive) Material, shipped in accordance with 49 CFR 173.428. Conditions include: (1) The basic contamination limits (above) apply to **external** surfaces of package. (2) Radiation level must be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any external surface. (3) Notice in §173.422(a)(4) must accompany shipment. (4) Package is in unimpaired condition & securely closed to prevent leakage. (5) Labels are removed, obliterated, or covered, and the "empty" label (§172.450) is affixed to the package.

In addition, **after any incident** involving spillage, breakage, or suspected contamination, the modal-specific DOT regulations (§177.861(a), highway; §174.750(a), railway; and §175.700(b), air) specify that vehicles, buildings, areas, or equipment have "no significant removable surface contamination," before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after incident.

Appendix B

Shipping Papers & Supporting Documents (6 Pages)
Driver's Instructions For Exclusive Use Vehicles (1 Page)
Driver's Instructions For Exclusive Use Vehicles (Hanford) (1 Page)

APPENDIX B
SHIPPING PAPERS AND SUPPORTING DOCUMENTS

RADIOACTIVE MATERIALS GUIDE - LOW LEVEL RADIATION

POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Low-level radioactive material; very low radiation hazard to people. Quantity of material presents low radiation hazard if released from package during accident.
- Some radioactive materials cannot be detected by commonly available instruments.
- Packages do not have RADIOACTIVE I, II, or III labels; while some may have EMPTY labels and/or the work "Radioactive" in the package marking.
- If any radioactive contamination occurs, it will be extremely low level.

FIRE OR EXPLOSION

- Some of these materials may burn, but most do not ignite readily.
- Radioactivity does not change flammability or other properties of the materials.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061**
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleaning until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- Presence of radioactive material will not change effectiveness of fire control techniques.
- Move containers from fire if you can do it without risk.
- Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts).

SPILL OR LEAK

- Do not touch damaged containers or spilled material.

Liquid Spills

- Cover with sand, earth or other noncombustible absorbent material.
- Cover powder spill with plastic sheet or tarp to minimize spreading.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury.
- Do not delay care and transport of a seriously injured person.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

This Emergency Response Guide applies to the following Identification Numbers :

- ☐ UN2910 Radioactive Material, Excepted Package - Articles Manufactured from Natural or Depleted Uranium or Natural Thorium
- ☐ UN2910 Radioactive Material, Excepted Package - Empty Packaging
- ☐ UN2910 Radioactive Material, Excepted Package - Instruments or Articles
- ☐ UN2910 Radioactive Material, Excepted Package - Limited Quantity of Material

RADIOACTIVE MATERIALS GUIDE - LOW to MODERATE LEVEL RADIATION

POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Undamaged packages are safe; contents of damaged packages may cause external and/r internal radiation exposure.
- Low radiation hazard when material is inside container. If material is released from package or bulk container, hazard will vary from low to moderate. Level of hazard will depend on the type and amount of radioactivity, the kind of material it is in, and/or the surfaces it is on.
- Some material may be released from packages during accidents of moderate severity. This poses little risk to people.
- Released radioactive materials or contaminated objects usually will be visible if packaging fails.
- Some radioactive materials cannot be detected by commonly available instruments.
- Some exclusive use shipments of bulk and packaged materials will not have "RADIOACTIVE" labels. Placards, markings, and shipping papers provide identification. Some packages may have a "Radioactive" label and a second hazard label. The second hazard is usually greater than the radiation hazard; so follow this guide as well as a response guide for the second label.
- Runoff from control of cargo fire may cause low-level pollution.

FIRE OR EXPLOSION

- Some of these materials may burn, but most do not ignite readily.
- Uranium and Thorium metal cuttings or granules may ignite spontaneously of exposed to air.
- Nitrates are oxidizers and may ignite other combustibles.

PUBLIC SAFETY

- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleaning until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- Presence of radioactive material will not change effectiveness of fire control techniques.
- Move containers from fire if you can do it without risk.
- Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts). Dike fire-control water for later disposal.

SPILL OR LEAK

- Do not touch damaged containers or spilled material.

Liquid Spills

- Cover with sand, earth or other noncombustible absorbent material.
- Dikes to collect large spills.
- Cover powder spill with plastic sheet or tarp to minimize spreading.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury.
- Do not delay care and transport of a seriously injured person.
- In case of contact with substance, wipe from skin immediately, flush skin or eyes with running water for at least 20 minutes.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

This Emergency Response Guide applies to the following Identification Numbers :

☐ UN2912 Radioactive Material, Low Specific Activity

RADIOACTIVE MATERIALS GUIDE - LOW to HIGH LEVEL RADIATION

POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Undamaged packages are safe; contents of damaged packages may cause external and/r internal radiation exposure.
- Type A packages (cartons, boxes, drums, articles, etc.) identified as "Type A" by marking on packages or by shipping papers contain non-life endangering amounts. Partial releases might be expected if "Type A" packages are damaged in moderately severe accidents.
- Type B packages (large and small, usually metal) identified as "Type B" by marking on packages or by shipping papers contain potentially life endangering amounts. Because of design, evaluation, and testing of packages, life endangering releases are not expected in accidents involving "Type B" packages except those of utmost severity.
- Radioactive White-I labels indicate radiation levels outside undamaged packages are very low (less than 0.005 mSv/h (o.5 mrem/h)).
- Radioactive Yellow-II and Yellow-III labeled packages have higher radiation levels. The transport index (TI) on the label identifies the maximum radiation level in mrem/h 1 meter from the package.
- Some radioactive materials cannot be detected by commonly available instruments.
- Runoff from control of cargo fire may cause low-level pollution.

FIRE OR EXPLOSION

- Some of these materials may burn, but most do not ignite readily.
- Radioactivity does not change flammability or other properties of materials.
- Type B packages are designed and evaluated to withstand total engulfment in flames at temperatures of 800°C (1475°F) for a period of 30 minutes.

PUBLIC SAFETY

- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleaning until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- Presence of radioactive material will not change effectiveness of fire control techniques.
- Move containers from fire if you can do it without risk.
- Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts). Dike fire-control water for later disposal.

SPILL OR LEAK

- Do not touch damaged containers or spilled material. Slightly damaged or damp outer surfaces seldom indicate failure of packaging since most have an inner container.

Liquid Spills

- Cover with sand, earth or other noncombustible absorbent material.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury. Do not delay care and transport of a seriously injured person.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

This Emergency Response Guide applies to the following Identification Numbers :

- ☐ UN2918 Radioactive Material, Fissile, n.o.s.
- ☐ UN2974 Radioactive Material, Special Form, n.o.s.
- ☐ UN2982 Radioactive Material, n.o.s.

RADIOACTIVE MATERIALS GUIDE - SPECIAL FORM/LOW to HIGH LEVEL RADIATION

POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Undamaged packages are safe; contents of damaged packages may cause external and/r internal radiation exposure.
- Contamination and internal radiation hazards are not expected, but not impossible.
- Type A packages (cartons, boxes, drums, articles, etc.) identified as "Type A" by marking on packages or by shipping papers contain non-life endangering amounts. Partial releases might be expected if "Type A" packages are damaged in moderately severe accidents.
- Type B packages (large and small, usually metal) identified as "Type B" by marking on packages or by shipping papers contain potentially life endangering amounts. Because of design, evaluation, and testing of packages, life endangering releases are not expected in accidents involving "Type B" packages except those of utmost severity.
- Radioactive White-I labels indicate radiation levels outside undamaged packages are very low (less than 0.005 mSv/h (o.5 mrem/h)).
- Radioactive Yellow-II and Yellow-III labeled packages have higher radiation levels. The transport index (TI) on the label identifies the maximum radiation level in mrem/h 1 meter from the package.
- Commonly available instruments can detect most of these materials.
- Runoff from cargo fire is not expected to cause pollution.

FIRE OR EXPLOSION

- Packaging can burn completely without risk of content loss from sealed source capsule.
- Radioactivity does not change flammability or other properties of materials.
- Radioactive source capsules and Type B packages are designed and evaluated to withstand total engulfment in flames at temperatures of 800°C (1475°F) for a period of 30 minutes.

PUBLIC SAFETY

- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Delay final cleanup until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- Presence of radioactive material will not change effectiveness of fire control techniques.
- Move containers from fire if you can do it without risk.
- Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts).

SPILL OR LEAK

- Do not touch damaged containers or spilled material. Slightly damaged or damp outer surfaces seldom indicate failure of packaging since most have an inner container.
- If source is identified as being out of package; stay away and await advice of Radiation Authority.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury. Do not delay care and transport of a seriously injured person.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Persons exposed to special form sources are not likely to be contaminated with radioactive material.

This Emergency Response Guide applies to the following Identification Numbers :

☐ UN2981 Uranyl Nitrate, Solid
☐ UN2980 Uranyl Nitrate Hexahydrate Solution
☐ UN2976 Thorium Nitrate, Solid

RADIOACTIVE MATERIALS GUIDE - FISSILE/LOW to HIGH LEVEL RADIATION

POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Undamaged packages are safe; contents of damaged packages may cause external and/r internal radiation exposure.
- Packages (drums or boxes) identified as "Type AF" or "IF" by marking on packages or by shipping papers contain materials that are not life endangering if released. External radiation levels are low and packages are designed, evaluated, and tested to control releases and to present a fission chain reaction under severe transport accident conditions.
- Packages (metal and usually very heavy) identified as "Type B(U)F" or "B(U)F" by marking on packages or by shipping papers contain potentially life endangering amounts. Because of design, evaluation, and testing of packages, fission chain reactions are prevented and releases are not expected to be life endangering for all accidents except those of utmost severity.
- The transport index (TI) on the labels or shipping paper might not indicate the radiation level at 1 meter from the package, instead, it may indicate controls needed during transport because of the fissile properties of the materials.
- Some radioactive materials cannot be detected by commonly available instruments.
- Runoff from control of cargo fire may cause low-level pollution.

FIRE OR EXPLOSION

- These materials are not flammable and packagings are designed to withstand fires without damage to contents.
- Radioactivity does not change flammability or other properties of materials.
- Type AF, Type IF, and Type B packages are designed and evaluated to withstand total engulfment in flames at temperatures of 800°C (1475°F) for a period of 30 minutes.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061**
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleaning until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- Presence of radioactive material will not change effectiveness of fire control techniques.
- Move containers from fire if you can do it without risk.
- Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts).

SPILL OR LEAK

- Do not touch damaged containers or spilled material. Slightly damaged or damp outer surfaces seldom indicate failure of packaging since most have an inner container.

Liquid Spills

- Package contents are seldom liquid. If any radioactive contamination resulting from a liquid release is present, it probably will be low-level.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury. Do not delay care and transport of a seriously injured person.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

This Emergency Response Guide applies to the following Identification Numbers :

- ☐ UN2975 Thorium Metal, Pyrophoric
- ☐ UN2979 Uranium Metal, Pyrophoric

POTENTIAL HAZARDS

HEALTH

- Chemical hazard greatly exceeds radiation hazard.
- Substance reacts with water and water vapor in air to form toxic and corrosive hydrogen fluoride gas and an extremely irritating and corrosive, white-colored, water-soluble residue. If inhaled, may be fatal. Direct contact causes chemical burns to skin, eyes, and respiratory tract.
- Low-level radioactive material; very low radiation hazard to people.
- Runoff from control of cargo fire may cause low-level pollution.
- Radiation presents minimal risk to transport works, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.

FIRE OR EXPLOSION

- Substance does not burn.
- Containers in protective overpacks (Horizontal cylindrical shape with short legs for tie-downs), also identified as "Type AF" or "B(U)F" on shipping papers or by marking on the overpack, are designed and evaluated to withstand severe accidents including total engulfment in flames at temperatures of 800°C (1475°F).
- Container may explode in heat of fire. The material may react violently with fuels.
- Radioactivity does not change flammability or other properties of the materials.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC, 1-800-424-9300 or for Military Shipments, 1-800-851-8061**
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions; keep unauthorized personnel away; stay upwind.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleaning until instructions are received from Radiation Authority.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

EMERGENCY ACTION

FIRE

- DO NOT USE WATER OR FOAM ON MATERIAL ITSELF.
- Move containers from fire if you can do it without risk.

Small Fires: Dry chemical, CO_2.

Large Fires

- Water spray, fog (flooding amounts). Cool containers with flooding quantities of water until well after fife is out. If this is impossible, withdraw from area and let fire burn.
- ALWAYS stay away from the ends of tanks.

SPILL OR LEAK

- Do not touch damaged packages or spilled material.
- Without fire or smoke, leak will be evident by visible and irritating vapors and residue foaming at the point of release. Residue buildup make self-seal small leaks.
- Use fine water spray to reduce vapors; do not put water directly on point of material release from container.
- Dike far ahead of spill to collect runoff water.

FIRST AID

- Medical problems take priority over radiological concerns; use first aid treatment according to the nature of the injury.
- Do not delay care and transport of a seriously injured person.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
- Injured persons who contacted released material may be a minor contamination problem to contacted persons, equipment, and facilities.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

This Emergency Response Guide applies to the following Identification Numbers :

☐ UN2977 Uranium Hexafluoride, Fissile
☐ UN2978 Uranium Hexafluoride

APPENDIX B
DRIVER'S INSTRUCTIONS FOR
EXCLUSIVE USE VEHICLES

The Code of Federal Regulations, 49CFR173.403(I) and 173.441(c and e) requires that specific instructions for maintenance of exclusive use shipment controls be provided by the shipper to the carrier. These instructions must be included with the shipment documents.

The following instructions shall be complied with for all exclusive use vehicles:

- Do not move or transfer packages within the conveyance or between conveyances while enroute to destination, without documented approval of shipper.
- The shipment must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.
- Shipments must be braced so as to prevent leakage or shifting of load under conditions normally incident to transportation.
- The vehicle must be placarded " RADIOACTIVE " on all four sides when applicable until shipment is unloaded.

If the vehicle is involved in an accident or is required to make emergency braking which would shift the load and change radiation levels, notify the shipper immediately.

Any deviation from these instructions is a violation of State and Federal laws and could result in carrier penalty.

_____ _____

Carrier's Representative Date

APPENDIX B
DRIVER'S INSTRUCTIONS FOR
EXCLUSIVE USE VEHICLES
HANFORD

..e Code of Federal Regulations, 49CFR173.403(I) and 173.441(c and e) requires that specific instructions for maintenance of exclusive use shipment controls be provided by the shipper to the carrier. These instructions must be included with the shipment documents.

The following instructions shall be complied with for all exclusive use vehicles:

- Do not move or transfer packages within the conveyance or between conveyances while enroute to destination, without notifying shipper.

- The shipment must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.

- Shipments must be braced so as to prevent leakage or shifting of load under conditions normally incident to transportation.

- The vehicle must be placarded " RADIOACTIVE " on all four sides when applicable until shipment is unloaded.

- Notify the Richland, Washington (Hanford) burial site within 24 hours of arrival: (509) 377-2411

- Notify Washington Port of Entry four (4) hours prior to arrival. I-90: (509) 226-3360; I-84: (509)783-4014.

If the vehicle is involved in an accident or is required to make emergency braking which uld shift the load and change radiation levels, notify the shipper immediately.

Any deviation from these instructions is a violation of State and Federal laws and could result in carrier penalty.

Carrier's Representative _____ Date _____

Appendix C

Prepackaged Waste Certification (1 Page)
Package Certification (1 Page)

APPENDIX C

PREPACKAGED WASTE CERTIFICATION

Date: _____ Generator Business Name: _____

Facility Location

Address: _____

_____

_____

Mailing Address (if different)

_____

_____

_____

Phone Number: (____) _____ Fax Number: (____) _____

Waste Destination: Storage: _____ Burial: _____ Other: _____

Destination Facility: _____ Contact Person: _____

To Help Us Help You

Do you have Process Knowledge Documentation for waste? Is it available? Yes_____ No_____

Is there a Sampling Analysis Plan? Is it available? Yes_____ No_____

Container Type(s): Example-drums, boxes, B-25's, etc.

_____

The number of containers by type, and date or dates on which they were packaged: _____

_____

Waste acceptance criteria may have been modified since date of original process

Does the waste contain any of the following?			Yes	No
RCRA/CERCLA/TSCA materials				
Biological and/or Pathogenic hazards	Which one(s)?			
Lead (other than as pre-approved shielding)				
Free-standing liquids	% of volume			
Absorbed Liquids	Sorbent type			
Oil or similar hydrocarbons	Which one(s)			
Encapsulated Waste	Media	PSI		
Solidified Waste	Media	PSI		
Compacted or Supercompacted waste				
Scintillation fluids				
NORM/NARM	Which type			
Other hazard or Special Waste Form	What?			
Any waste form whose physical characteristics could be altered by certain transport/storage conditions.	What?			

The packaged waste being brokered is verified to meet the Conditions and Limitations of the Waste Acceptance Criteria and Radioactive Materials license of the destination facility; or a deviation has been granted, in writing, by the appropriate regulatory authority(ies).

Authorized Generator signature: _____ Title/Position: _____

Broker: _____ Waste Packager: _____

Appendix C
PACKAGE CERTIFICATION

(EXAMPLE CERTIFICATE ENCLOSED IN/OR ON PACKAGE, INCLUDED WITH THE PACKING LIST OR OTHERWISE FORWARDED WITH THE PACKAGE)

This package conforms to the conditions, and limitations specified
in 49 CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910.

_____

[Signed] Radiation Safety Officer

Appendix D

Copy Distribution Checklist
Barnwell Waste Management (1 Page)
Hanford NORM/LLRW Site (1 Page)
Envirocare of Utah (1 Page)

APPENDIX D
COPY DISTRIBUTION CHECKLIST
BARNWELL WASTE MANAGEMENT

	Disposal Site	Shipper	Carrier	M.M.S.	CWB	Mail Copy
RSM	orig	2nd orig	3rd orig	copy	copy	copy
Bill of Lading	copy	copy	orig	copy	copy	N/A
DHEC 803	orig	copy	copy	copy	copy	N/A
DHEC 802	orig	copy	copy	copy	copy	N/A
*Driver Instruction Exclusive Use	copy	copy	orig	copy	copy	N/A
Waste Inventory Sheet	N/A	copy	N/A	copy	orig	N/A
Truck Survey	copy	copy	copy	copy	orig	N/A
Admin Info	N/A	N/A	N/A	copy	orig	N/A
*HIC Certification	copy	copy	N/A	copy	copy	N/A
*NRC Form 741	orig	copy	N/A	copy	copy	N/A
*Isotopic Analysis	copy	copy	N/A	copy	copy	N/A
Class C Cert.	orig	copy	N/A	copy	copy	N/A
*Compact Export Certification	orig	copy	N/A	copy	copy	N/A
*Variance Letter	copy	copy	N/A	copy	copy	N/A
Radwaste Program Certification	orig	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	orig	copy	copy	copy

* Only if applicable

APPENDIX D
COPY DISTRIBUTION
HANFORD NORM/LLRW SITE

	Disposal Site	Shipper	Carrier	M.M.S.	CWB	Mail
RSM	orig & 3rd orig	4th orig	5th orig	copy	copy	2nd orig
Bill of Lading	copy	copy	orig	copy	copy	N/A
WA Certification DHS-RHF-31B	orig	copy	copy	copy	copy	N/A
Prior notification call sheet	copy	copy	copy	copy	orig	N/A
*Driver Instruction	copy	copy	orig	copy	copy	N/A
Waste Inventory	N/A	copy	N/A	copy	orig	N/A
Truck Survey	copy	copy	copy	copy	orig	N/A
Admin. Info	N/A	N/A	N/A	copy	orig	N/A
* Compact Export Certification	orig	copy	N/A	copy	copy	N/A
*Variance Letter	orig	copy	N/A	copy	copy	N/A
*NRC Certification	orig	copy	N/A	copy	copy	N/A
*Port of Entry (CVSA)	orig	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	orig	copy	copy	copy

* Only as Applicable

APPENDIX D
COPY DISTRIBUTION
ENVIROCARE of UTAH

	Consignee	Shipper	Carrier	M.M.S.	CWB	Mail
RSM	orig	copy	copy	copy	copy	copy
Bill of Lading	copy	copy	orig	copy	copy	N/A
*Driver Instructions	copy	copy	orig	copy	copy	N/A
Waste Inventory	N/A	copy	N/A	copy	orig	N/A
Truck Survey	copy	copy	copy	copy	orig	N/A
Admin. Info	N/A	N/A	N/A	copy	orig	N/A
*NRC Form 741	orig	copy	N/A	copy	copy	N/A
LDR Notification	orig	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	orig	copy	copy	copy

* Only as Applicable

Appendix E

Post Checklist of Waste Broker's Waste (3 Pages)
Pre-Departure Guide (3 Pages)

POST CHECK LIST OF SHIPPER'S WORK

Check or N/A as applicable

A. Container Inspection

1. _____ Container integrity satisfactory
2. _____ Clean, contents inspected, no free -standing liquid
3. _____ Solidified drums tapped
4. _____ No wooden boxes
5. _____ Metal boxes clipped
6. _____ Caulking visible on boxes
7. _____ Drum lids sealed
8. _____ Lock nuts tight
9. _____ Tamper seal (non-exclusive use, non-LSA)
10. _____ Survey container
11. _____ Dose rate recorded on container
12. _____ Item/weight label (completed)
13. _____ Waste classification/stability
14. _____ Proper shipping name and I.D. number marking
15. _____ Specification labels (two sides)
16. _____ Contents that can shift are fixed in place

B. Loading

1. _____ Conduct and record initial survey of trailer
2. _____ Hot containers shielded from exterior
3. _____ Drums weighing greater than 1000 lbs. palletized
4. _____ Check with driver about weight placement
5. _____ Load properly braced and secured
6. _____ Truck placarded
7. _____ Conduct and record final truck survey
8. _____ Seal doors on trailer

C. Cask Inspection

1. Tie-Downs:

_____ a. Tightness (no slack)
_____ b. Turn buckles/ratchet binders (handles secure)
_____ c. Cable clamps properly installed
_____ d. No sharp objects to damage cable or chains
_____ e. Tie-down attachment welds (no cracks)
_____ f. Cable/chain conditions (do not touch)

2. Liner:

_____ a. Type Serial No.
_____ b. Barrel top covers (pipe caps in place)
_____ c. QA Inspection sticker (on liner)
_____ d. Liner properly marked for Class (A,B,C)

3. Cask Cover/Lid:

_____ a. Nuts/bolts/washers (condition, lubricated, torqued)
_____ b. Lids bolted/cask seal affixed
_____ c. Rain cover installed (proper tie-down)
_____ d. Lid lifting shackles/rings, lugs properly covered
_____ e. Lid top surface clean

4. General:

_____ a. Cask trailer base retainer plates in place
_____ b. Cask in proper location on trailer
_____ c. Paint appearance/nameplate/cleanliness of cask

D. Shipping Papers

1._____ RSM continuation sheets completed
2. Cover sheet:

_____ a. Driver's signature
_____ b. Both release signatures
_____ c. Check for entries in every block
_____ d. Verify totals
_____ e. Ensure generator's state & compact is identified appropriately
_____ f. Ensure Emergency Response information is entered

3._____ Complete broker package administrative sheet
4._____ Bill of Lading:

_____ a. Number of packages
_____ b. Hazardous material column
_____ c. Proper shipping name and I.D. number
_____ d. RQ entered
_____ e. Weight
_____ f. Description
_____ g. Radionuclides
_____ h. Total activity
_____ i. Physical form
_____ j. Chemical form

POST CHECK LIST OF SHIPPER'S WORK
(Continued)

_____ k. Specification Label or non-specification marking
_____ l. T. I.
_____ m. Container Type
_____ n. L. Q./I.& A. Certification Statement
_____ o. Time/date - arrived/departed
_____ p. Exclusive use statement
_____ q. Page numbers if continuation (ised
_____ r. Driver's signature
_____ s. Shipper's signature

5. Complete radioactive waste shipment certification forms:
_____ a. Shipper's signature
_____ b. Driver's signature
_____ c. Broker's signature (Hanford)
6.___ Complete Driver's Instructions for exclusive use vehicles for DOD shipments. Check driver's signature.
7.___ Corrections to DHEC 802
8.___ Shipping papers and copies legible
9.___ Reproduce copies:
____ a. Shipper's copy
____ b. Carrier copy
____ c. Site copy
____ d. Broker copy
____ e. IOC Copy
____ f.
____ g.
____ h.
10. Prior notification calls:
____ a.
____ b.
____ c.

____ d.
____ e.
____ f.

_____ _____
Signature Date

PRE-DEPARTURE GUIDE

I. Initial contact with generator (phone_____)

A. Description of material_____

B. Amount - Volume _____(Act/est)_____

C. Activity _____(Act/est)_____

D. Tentative dates_____

E. Permit number_____

F. Directions to Site_____

G. Handling equipment available (if required)_____

II. Office Work Up

A. Planning Job

1. Classification of material

2. How will it be shipped

3. Waste category

4. Man hours and equipment needed

5. Shipping arrangements (materials)

6. Shipping ID #/Generator number_____

7. Permission or Permit to Export/import to Compact

8. Submit DHEC 802

9. Submit support paperwork if necessary

10. Transportation

B. Re-contact generator

1. Changes since last contact - additional information

2. Shipping dates_____

3. Materials to be supplied by customer

PRE-DEPARTURE GUIDE
(Continued)

Material needed for job:

A. Instruments

1. AN/PDR 27 or comparable instrument
2. Alpha meter
3. Additional instruments

B. Lablels

1. White I
2. Yellow II
3. Yellow III
4. Empty
5. Corrosive
6. Oxidizer
7. Flammable liquid
8. Flammable solid
9. Spontaneously combustible
10. Organic peroxide
11. Other

C. Markings

1. Specification
    a. Proper shipping name and I.D.
    b. Consignor/consignee name and address
    c. Item number/weight
    d. Container specification

2. Non-specification
    a. Radioactive (limited quantity)
    b. Radioactive-LSA (exclusive use)
    c. Waste class: A_____, B_____,C_____
    d. Stable _____, Unstable_____

PRE-DEPARTURE GUIDE
(Continued)

e. Dry solid

f. Absorbed liquids

g. Biological

h. Certification statement (limited quantity)

D. Other Materials Needed

1. Ruler
2. Calculator
3. Marking pencils
4. Batteries
5. Paper
6. Rubber bands
7. Clip boards
8. Placards
9. Seals
10. Smears
11. Necessary tools
12. Shipping envelopes

E. Travel Arrangements

1. Confirm plane, hotel and car reservations
2. TDY orders
3. Passport
4. Visa

Appendix F

Waste Inventory Sheet (1 Page)
Vehicle Inspection Sheet (1 Page)
Vehicle Radiation/Contamination Survey (1 Page)
Trailer Survey (1 Page)

WASTE INVENTORY SHEET

Package ID	Activity, mCi	Class AS,AU,B,C	Contamination	Weight	mR/hr @ contact	mR/hr @ 1 meter	Container Spec.	Marking/ Labeling	Inspected/ Loaded

Survey Performed by:_____ Shipment #:_____

Instrument Type(s):_____ Serial#:_____ Cal Due Date:_____

Instrument Type(s):_____ Serial#:_____ Cal Due Date:_____

Instrument Type(s):_____ Serial#:_____ Cal Due Date:_____

VEHICLE INSPECTION SHEET

Shipment # _____ Disposal Shipment # _____ USDOT Hazmat Reg # _____

Carrier name/address _____ Tractor # _____

_____ Trailer # _____

Driver's Name: State: License #: Exp Date:

1	Operator's License	( )SAT	( )UNSAT	Driver possesses valid commercial driver's license (with a tank vehicle /hazardous materials endorsement)
2	Windshield, Side Glass & Mirror	( )SAT	( )UNSAT	No cracked or broken glass that would affect the driver's vision. Mirror(s) in place and usable.
3	Wipers	( )SAT	( )UNSAT	Wipers operate and are in good condition.
4	Horn	( )SAT	( )UNSAT	Air/electric horn works.
5	Suspension	( )SAT	( )UNSAT	Visually check for loose, broken, or damaged spring leaves, "U" bolts, shackles, pads, torque arms, and locking pins.
6	Brake Lines	( )SAT	( )UNSAT	Brake lines and connectors do not have cracks, crimps, restrictions, or evidence of damage or audible air leaks.
7	Brake Pots & Cams	( )SAT	( )UNSAT	Brake pots are in good physical condition and mechanical linkages are intact and in good condition.
8	Exhaust System	( )SAT	( )UNSAT	No loose or broken brackets and no evidence of leaks which would affect driving/sleeping compartment.
9	Fuel System	( )SAT	( )UNSAT	No damage affecting fuel tank integrity, no visible leaks, no loose or broken mounting brackets, no evidence of damage to vents, and fuel cap is securely in place.
10	Structure&Welds	( )SAT	( )UNSAT	No cracks in load bearing welds or assemblies.
11	Frame	( )SAT	( )UNSAT	No cracked, loose, sagging, or broken frame.
12	Van/Trailer Floor	( )SAT	( )UNSAT	No holes or projecting nails. Capable of bearing weight of load and fork truck (if used).
13	Van walls, ceiling	( )SAT	( )UNSAT	No holes, severe dents, or buckling.
14	Van doors	( )SAT	( )UNSAT	Can be closed and secured properly.
15	Rims	( )SAT	( )UNSAT	Rims are not bent or cracked, and stud nuts are in
16	Tires	( )SAT	(UNSAT	Tires appear properly inflated, tread depths appear greater than minimum (major tread depth at least 1/8" on front and 1/16" on all others) and show no evidence of cuts or damage affecting the placard.
17	Hubs	( )SAT	( )UNSAT	Oil level visible, no visible oil leakage from seals.
18	Head lights	( )SAT	( )UNSAT	Both low beams working.
19	Running Lights	( )SAT	( )UNSAT	All affixed running lights operable.
20	Turn Signals	( )SAT	( )UNSAT	Front and back working.
21	Brake Lights	( )SAT	( )UNSAT	Must work on tractor and trailer.
22	Bracing	( )SAT	( )UNSAT	Bracing/shoring must be sufficient to prevent shifting of lading during conditions normally incident to transportation.

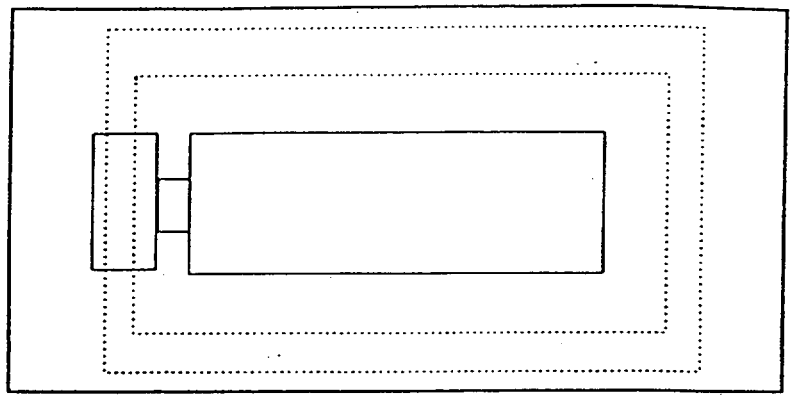
Tractor & Trailer ( ) are ( ) are not acceptable for use.

VEHICLE RADIATION / CONTAMINATION SURVEY

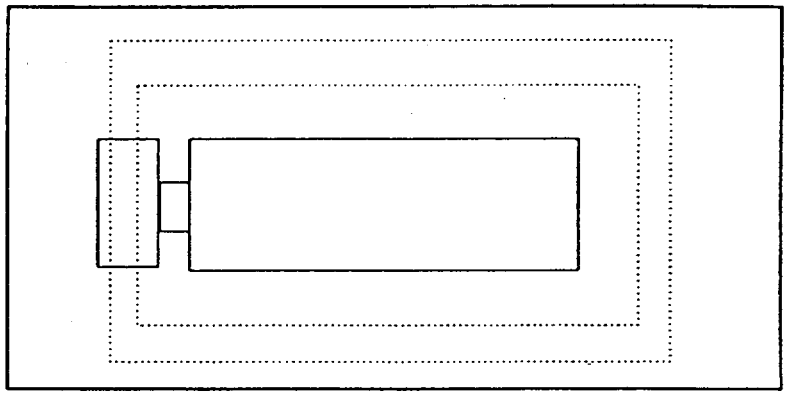
Frisk / Smear	β γ	α	Fixed (CPM)

βγ and α readings given in DPM/100cm²

Incoming Survey



Outgoing Survey



Incoming:

Tractor #_____ **Trailer #**_____

Outgoing:

Tractor #_____ **Trailer #**_____

DO NOT EXCEED 200 mR/hr ON CONTACT, 10 mR/hr @ 2 METERS, 2 mR/hr IN TRACTOR CAB /SLEEPER

□/Smear Location O/Contact ___ #/Area Highest Contact _____ Highest Gen Area _____
(All Dose Rates in mR/hr)

SURVEY INSTRUMENT/TYPE	SERIAL #	CAL. DUE DATE

Surveyor: _____/_____
Sign/Print Date

TE/TIME OF SURVEY: _____/_____ REVIEWED BY: _____/_____
Sign/Print

TRAILER SURVEY

Shipment ID Number: _____

Surveyed Performed by: _____

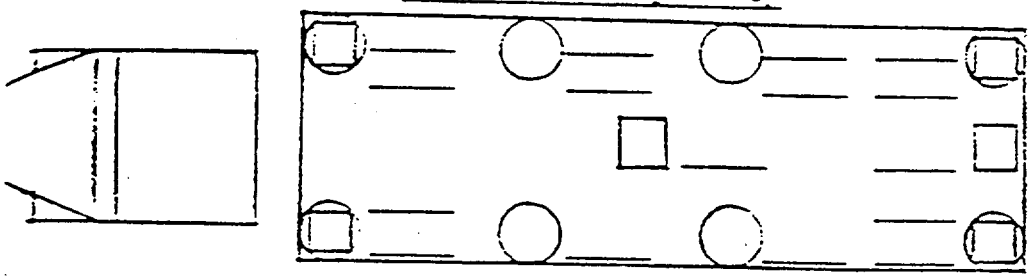
Instrument Used: _____

Date Calibrated: _____

○ = mr/hr

□ = dpm/100cm^2

Initial Incoming Survey



Vehicle Condition: Accept___ Reject___

Outgoing Shipment Survey